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Funk et al.

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[54] **METHOD AND APPARATUS FOR HIGH VOLUME E-MAIL DELIVERY**

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[21] Appl. No.: **08/710,964**

[22] Filed: **Sep. 24, 1996**

Related U.S. Application Data

[63] Continuation-in-part of application No. 08/431,254, Apr. 6, 1995.

[51] **Int. Cl.**[6] **G06F 17/00**

[52] **U.S. Cl.** **395/200.36**; 395/200.47

[58] **Field of Search** 395/200.36, 200.37, 395/200.68, 200.74, 200.49, 200.47; 379/93.01, 93.24, 100.08; 705/14

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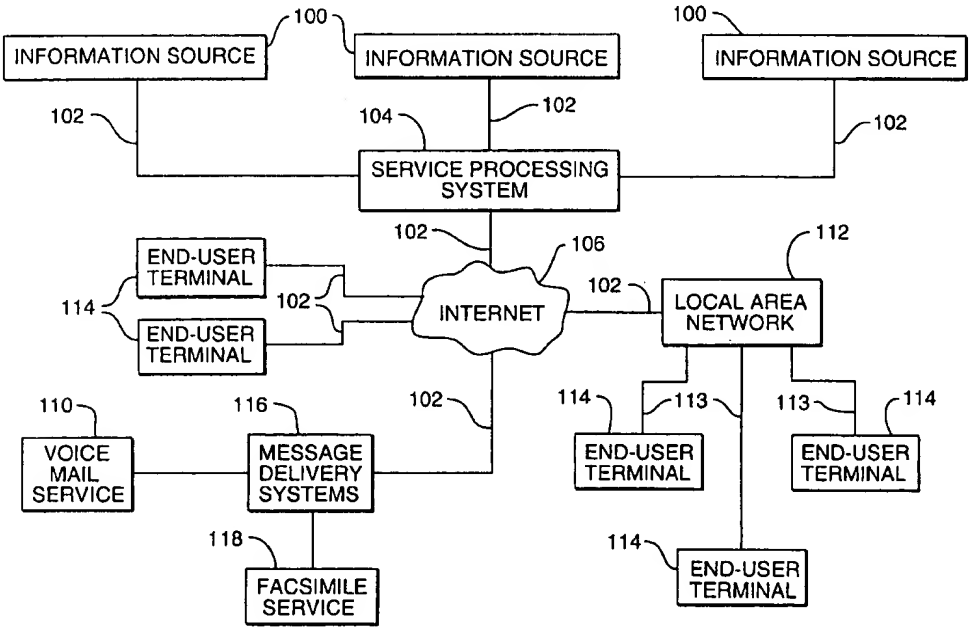
Attorney, Agent, or Firm—Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.

[57] **ABSTRACT**

A high volume e-mail "newspaper" delivery system contains, for each customer, a personal configuration file containing the information resources that the customer would like e-mailed to his desktop. The configuration file is highly customizable, allowing the end-user detailed control over the content, format, and timing of the delivered e-mails. The e-mail messages to be sent are hashed to multiple, parallel transmission queues based on their destination MX hosts. This arrangement of transmission queues significantly increases total e-mail output because multiple queues are simultaneously processing the e-mail transmissions. A unique job number is appended to each e-mail message as it is created. The job number is used by the system to identify and track the e-mail message through the system before it is transmitted, and if the message bounces, when it returns to the system.

46 Claims, 14 Drawing Sheets



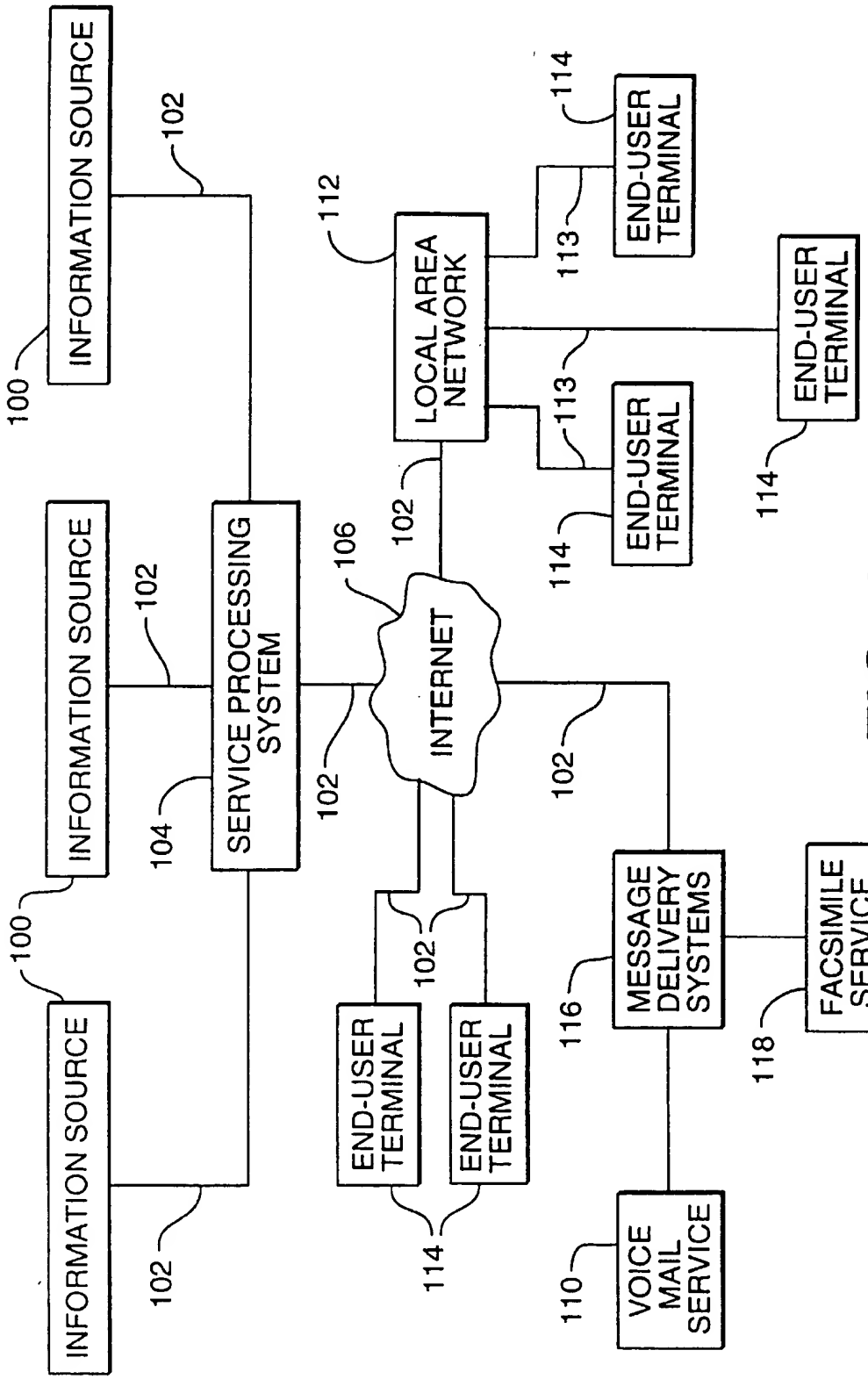

INFORMATION SOURCE
INFORMATION SOURCE
INFORMATION SOURCE
SERVICE PROCESSING SYSTEM
INTERNET
LOCAL AREA NETWORK
END-USER TERMINAL
END-USER TERMINAL
END-USER TERMINAL
END-USER TERMINAL
END-USER TERMINAL
MESSAGE DELIVERY SYSTEMS
FACSIMILE SERVICE
VOICE MAIL SERVICE
100
102
104
106
110
112
113
114
116
118

FIG. 1

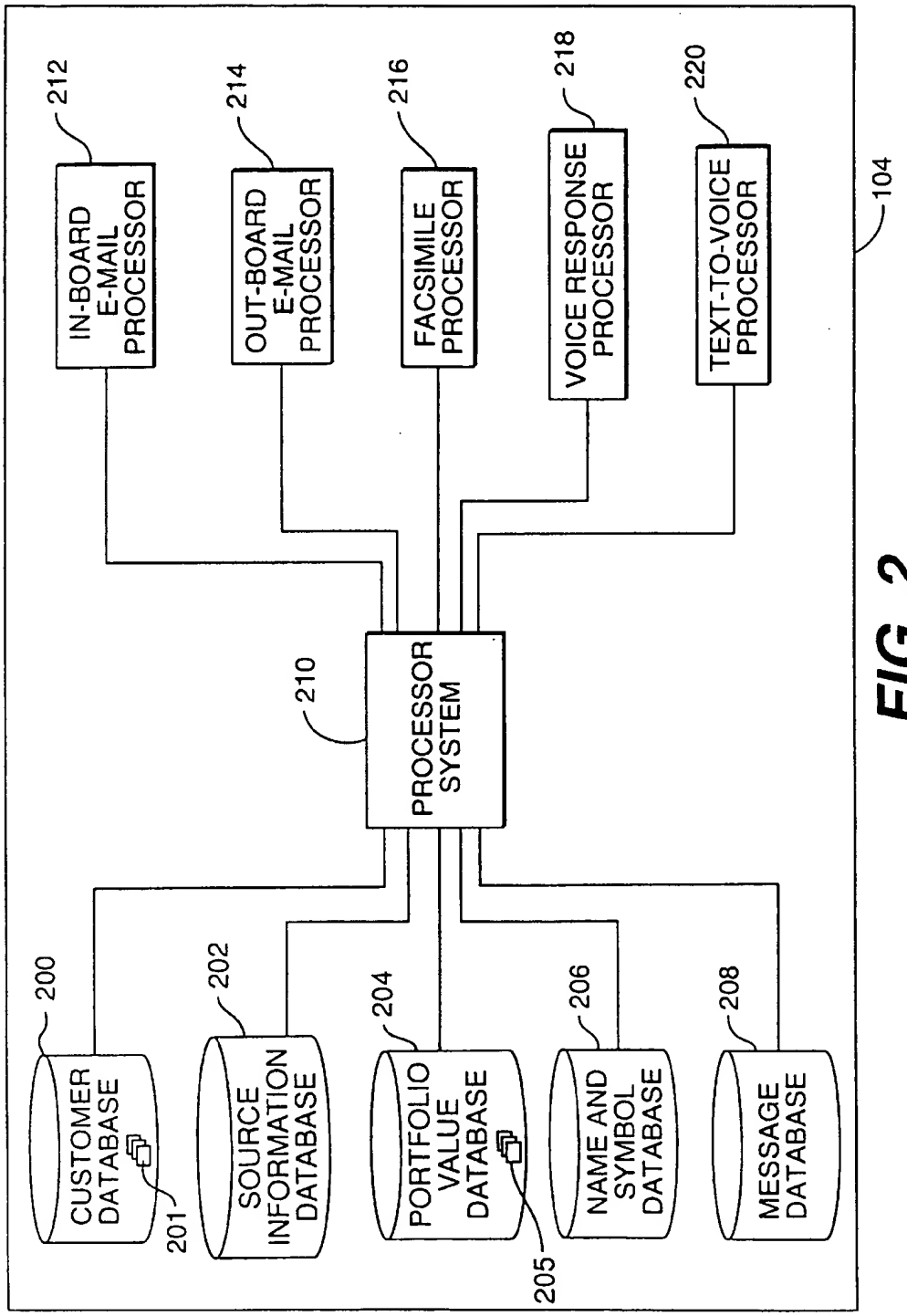

212
214
216
218
220
IN-BOARD E-MAIL PROCESSOR
OUT-BOARD E-MAIL PROCESSOR
FACSIMILE PROCESSOR
VOICE RESPONSE PROCESSOR
TEXT-TO-VOICE PROCESSOR
104
210
PROCESSOR SYSTEM
200
202
204
206
208
CUSTOMER DATABASE
201
SOURCE INFORMATION DATABASE
PORTFOLIO VALUE DATABASE
205
NAME AND SYMBOL DATABASE
MESSAGE DATABASE

FIG. 2

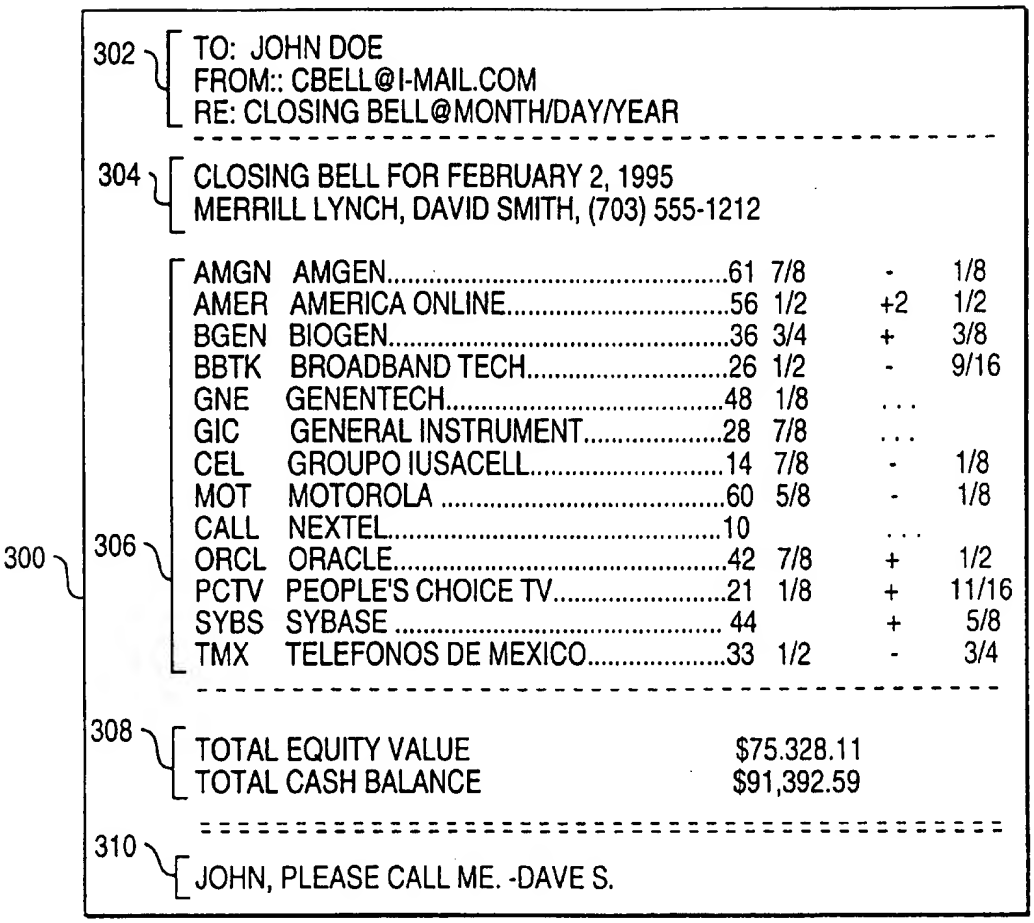

300
302
TO: JOHN DOE
FROM:: CBELL@I-MAIL.COM
RE: CLOSING BELL@MONTH/DAY/YEAR
304
CLOSING BELL FOR FEBRUARY 2, 1995
MERRILL LYNCH, DAVID SMITH, (703) 555-1212
306
AMGN AMGEN 61 7/8 - 1/8
AMER AMERICA ONLINE 56 1/2 +2 1/2
BGEN BIOGEN 36 3/4 + 3/8
BBTK BROADBAND TECH 26 1/2 - 9/16
GNE GENENTECH 48 1/8 . . .
GIC GENERAL INSTRUMENT 28 7/8 . . .
CEL GROUPO IUSACELL 14 7/8 - 1/8
MOT MOTOROLA 60 5/8 - 1/8
CALL NEXTEL 10 . . .
ORCL ORACLE 42 7/8 + 1/2
PCTV PEOPLE'S CHOICE TV 21 1/8 + 11/16
SYBS SYBASE 44 + 5/8
TMX TELEFONOS DE MEXICO 33 1/2 - 3/4
308
TOTAL EQUITY VALUE $75.328.11
TOTAL CASH BALANCE $91,392.59
310
JOHN, PLEASE CALL ME. -DAVE S.

FIG. 3

200

CUSTOMER DATABASE (INFORMATION ON CUSTOMER'S DESIRED SECURITIES.)

FIELD 1->	EMAIL	CHAR 100	E-MAIL ADDRESS OF CUSTOMER
FIELD 2->	DECIMAL	LOGICAL	DEFINE NON-INDEX SECURITY DISPLAY (FRACTION/DECIMAL) DEFAULT FALSE
FIELD 3->	PRIORITY	NUM 1	PRIORITY OF E-MAIL DISTRIBUTION
FIELD 4->	CUST_REF	CHAR 25	UNIQUE CUSTOMER NUMBER; INCLUDES CHARACTER TO INDICATE BROKERAGE FIRM
FIELD 5->	CUST_ID	CHAR 10	UNIQUE CUSTOMER NUMBER (INTERNAL TO IMAIL)
FIELD 6->	CUST_NAME	CHAR 50	CUSTOMR NAME
FIELD 7->	CUST_ADD1	CHAR 25	CUSTOMER ADDRESS LINE 1
FIELD 8->	CUST_ADD2	CHAR 25	CUSTOMER ADDRESS LINE 2
FIELD 9->	CUST_CITY	CHAR 25	CITY
FIELD 10->	CUST_ST	CHAR 2	STATE
FIELD 11->	CUST_ZIP	CHAR 9	ZIP
FIELD 12->	CUST_CY	CHAR 20	COUNTRY
FIELD 13->	CUST_PHONE	NUM 10	CUSTOMER PHONE
FIELD 14->	GREETING	CHAR 35	GREETING TO USE IN E-MAIL MESSAGE
FIELD 15->	REC_OPEN	DATE	DATE RECORD CREATED
FIELD 16->	REC_MOD	DATE	DATE RECORD LAST MODIFIED
FIELD 17->	BROKER	CHAR 70	BROKER NAME AND PHONE NUMBER (2ND LINE OF MESSAGE)
FIELD 18->	EXPIRE	DATE	SUBSCRIPTION EXPIRATION (IF APPROPRIATE)
FIELD 19->	RATE	NUM 5,2	SUBSCRIPTION RATE (IF APPLICABLE)
FIELD 20->	SUSPEND	DATE	SUSPEND DELIVERIES UNTIL THIS DATE
FIELD 21->	RSA_TICK	CHAR 25	PUBLIC ENCRYPTION KEY
FIELD 22->	TRACK1	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 23->	TRACK 2	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 24->	TRACK 3	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 25->	TRACK 4	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 26->	TRACK 5	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 27->	TRACK 6	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 28->	TRACK 7	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 29->	TRACK 8	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 30->	TRACK 9	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 31->	TRACK 10	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 32->	TRACK 11	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 33->	TRACK 12	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 34->	TRACK 13	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 35->	TRACK 14	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 36->	TRACK 15	CHAR 10	CONTAINS SYMBOL OF SECURITY TO TRACK
FIELD 37->	REC_MOD	DATE	DATE RECORD LAST MODIFIED

FIG. 4A

202

SOURCE INFORMATION DATABASE (INFORMATION ON STOCKS, BONDS, MUTUAL FUNDS, INDEXES,[OPTIONS, CURRENCIES])

FIELD 1->	EXCHANGE	CHAR 1	EXCHANGE WHERE SECURITY TRADED
FIELD 2->	SYMBOL	CHAR 10	TICKER OR REFERENCE SYMBOL FOR SECURITY
FIELD 3->	CLOSE	NUM 10,4	CLOSING PRICE FOR SYMBOL
FIELD 4->	CHANGE	NUM 8,4	CHANGE IN PRICE FOR SYMBOL FROM PRIOR TRADING DAY
FIELD 5->	VOLUME	NUM 7	VOLUME OF SHARES TRADED FOR SYMBOL
FIELD 6->	HIGH	NUM 10,4	HIGH PRICE FOR SYMBOL DURING DAY
FIELD 7->	LOW	NUM 10,4	LOW PRICE FOR SYMBOL DURING DAY
FIELD 8->	OPEN	NUM 10,4	OPENING PRICE FOR SYMBOL DURING DAY
FIELD 9->	HIGH52	NUM 10,4	52 WEEK HIGH FOR SECURITY
FIELD 10->	LOW52	NUM 10,4	52 WEEK LOW FOR SECURITY
FIELD 11->	SPLIT	LOGICAL	RECENT SHARE SPLIT

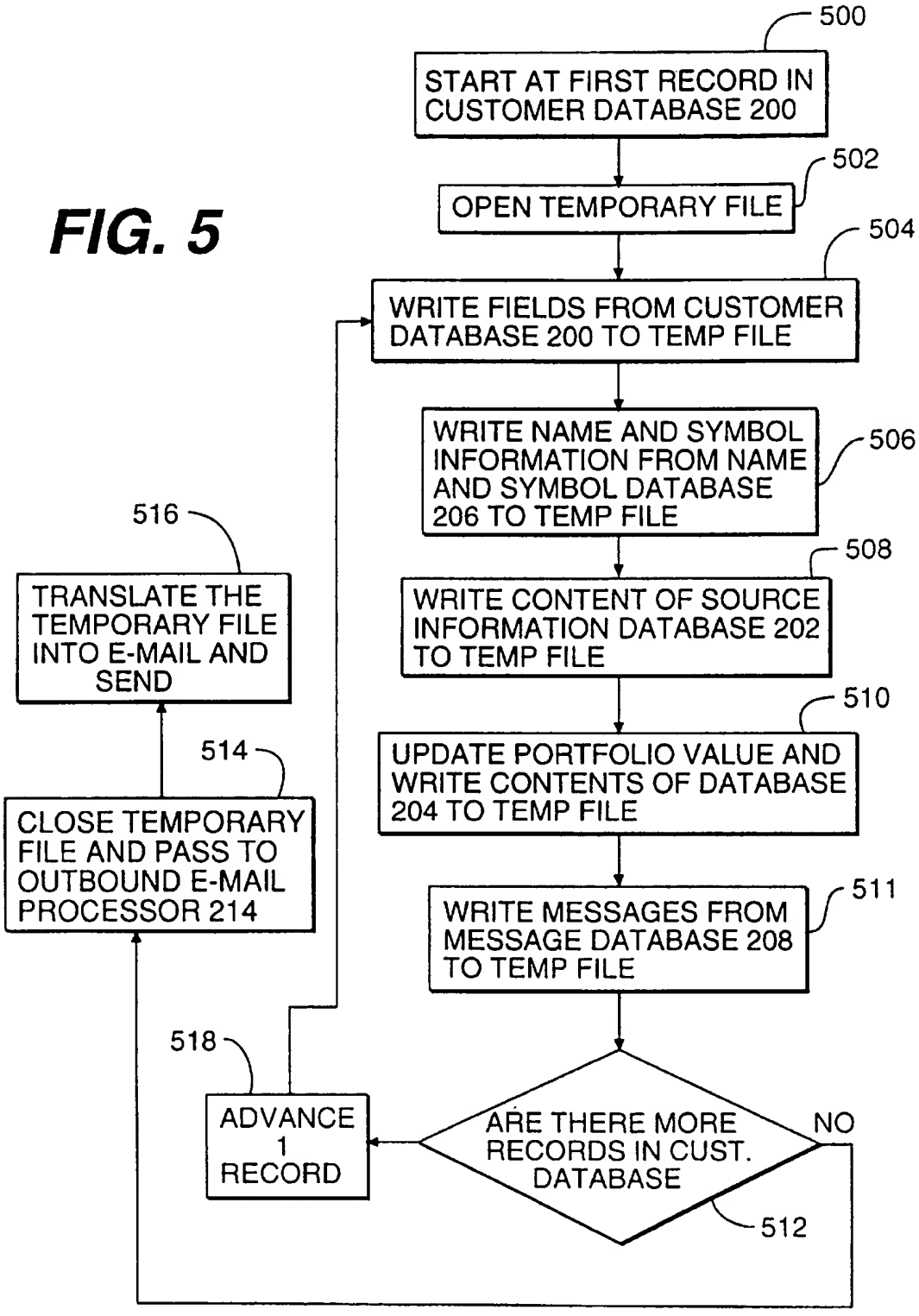
206

NAMES AND SYMBOLS DATABASE (REFERENCE DB ON SYMBOLS & SECURITY NAMES)

FIELD 1->	SYMBOL	CHAR 10 TICKER OR REFERENCE SYMBOL FOR SECURITY
FIELD 2->	SEC_NAME	CHAR 25 SECURITY NAME OF SYMBOL

FIG. 4B

FIG. 5


500
START AT FIRST RECORD IN CUSTOMER DATABASE 200
502
OPEN TEMPORARY FILE
504
WRITE FIELDS FROM CUSTOMER DATABASE 200 TO TEMP FILE
506
WRITE NAME AND SYMBOL INFORMATION FROM NAME AND SYMBOL DATABASE 206 TO TEMP FILE
508
WRITE CONTENT OF SOURCE INFORMATION DATABASE 202 TO TEMP FILE
510
UPDATE PORTFOLIO VALUE AND WRITE CONTENTS OF DATABASE 204 TO TEMP FILE
511
WRITE MESSAGES FROM MESSAGE DATABASE 208 TO TEMP FILE
ARE THERE MORE RECORDS IN CUST. DATABASE
NO
512
518
ADVANCE 1 RECORD
514
CLOSE TEMPORARY FILE AND PASS TO OUTBOUND E-MAIL PROCESSOR 214
516
TRANSLATE THE TEMPORARY FILE INTO E-MAIL AND SEND

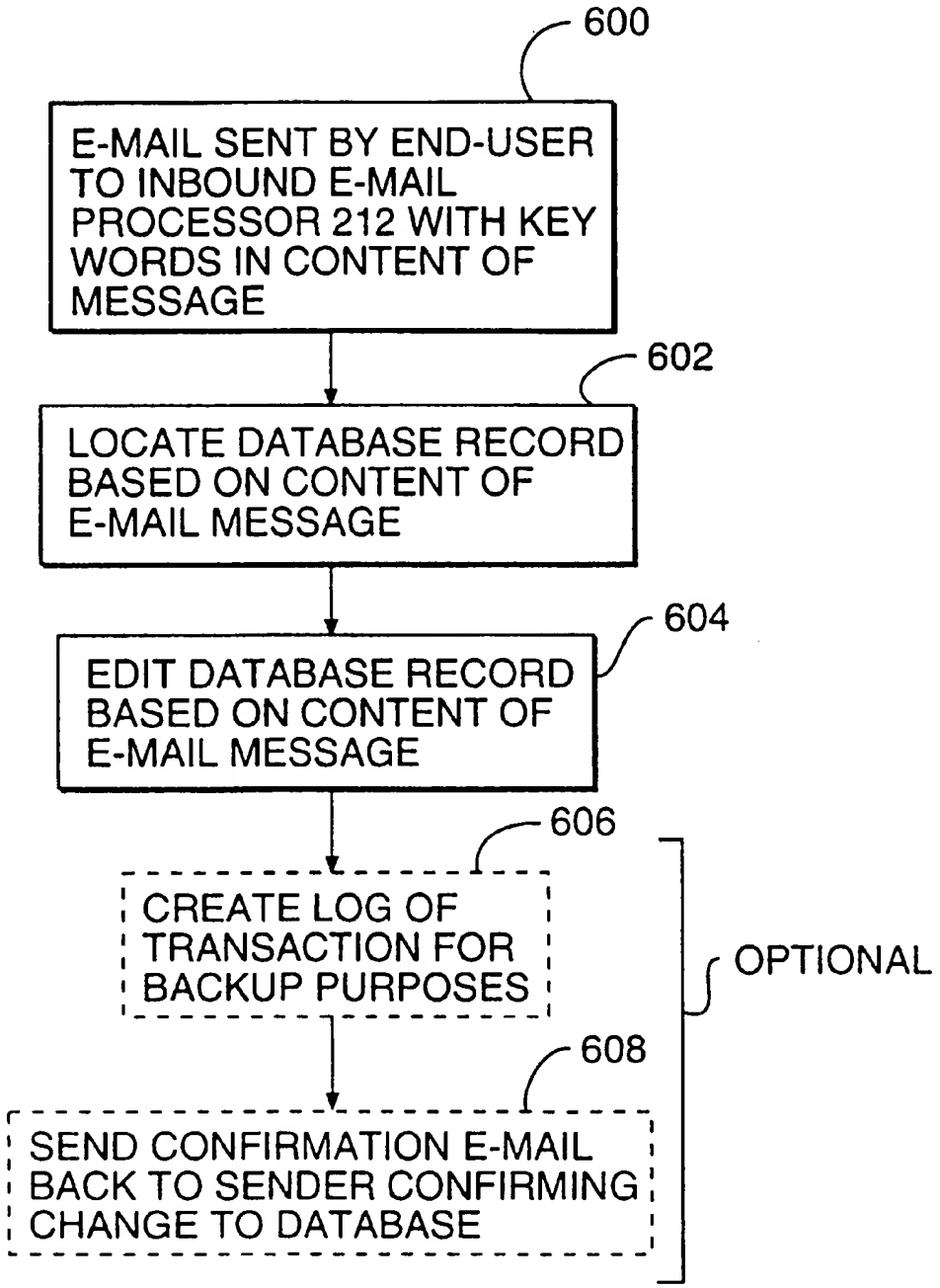

600
E-MAIL SENT BY END-USER TO INBOUND E-MAIL PROCESSOR 212 WITH KEY WORDS IN CONTENT OF MESSAGE
602
LOCATE DATABASE RECORD BASED ON CONTENT OF E-MAIL MESSAGE
604
EDIT DATABASE RECORD BASED ON CONTENT OF E-MAIL MESSAGE
606
CREATE LOG OF TRANSACTION FOR BACKUP PURPOSES
608
SEND CONFIRMATION E-MAIL BACK TO SENDER CONFIRMING CHANGE TO DATABASE
OPTIONAL

FIG. 6

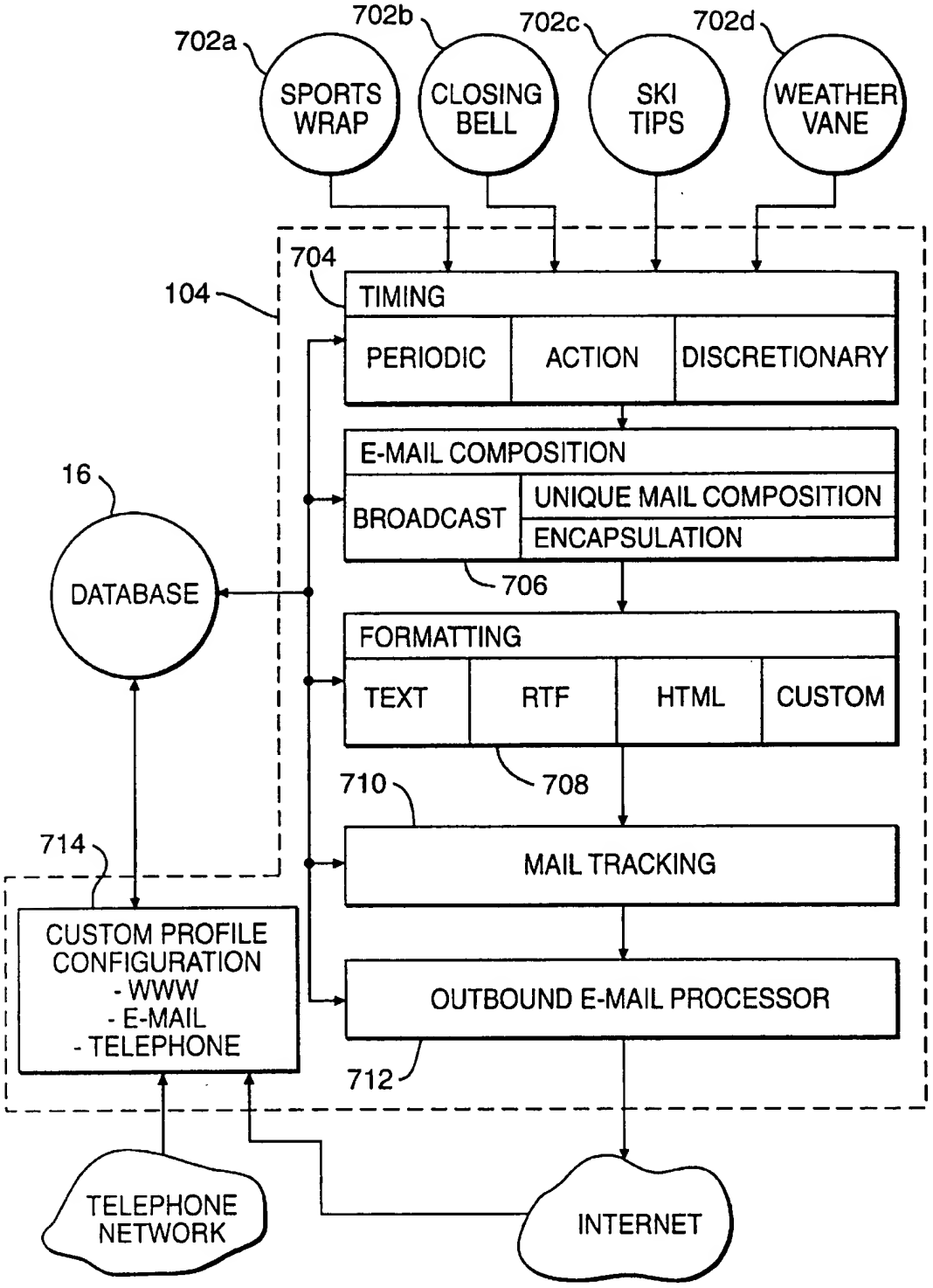

702a
SPORTS WRAP
702b
CLOSING BELL
702c
SKI TIPS
702d
WEATHER VANE
104
704
TIMING
PERIODIC
ACTION
DISCRETIONARY
E-MAIL COMPOSITION
BROADCAST
UNIQUE MAIL COMPOSITION
ENCAPSULATION
706
16
DATABASE
FORMATTING
TEXT
RTF
HTML
CUSTOM
708
710
MAIL TRACKING
714
CUSTOM PROFILE CONFIGURATION
- WWW
- E-MAIL
- TELEPHONE
OUTBOUND E-MAIL PROCESSOR
712
TELEPHONE NETWORK
INTERNET

FIG. 7

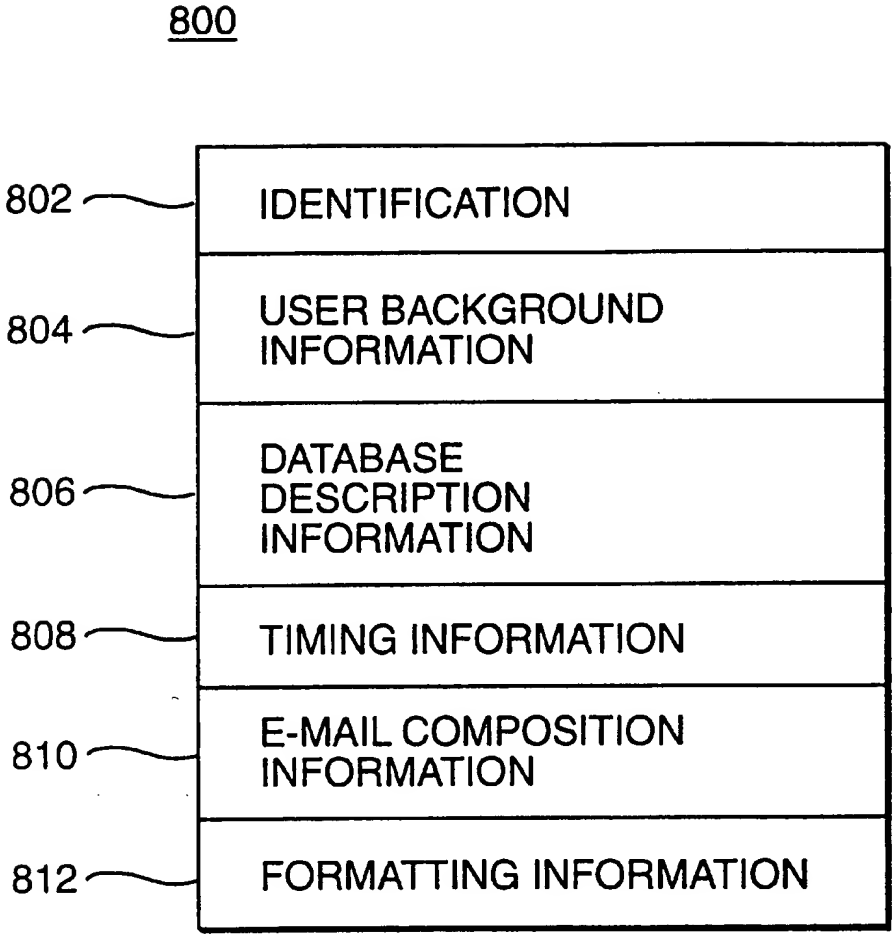

800
802
IDENTIFICATION
804
USER BACKGROUND INFORMATION
806
DATABASE DESCRIPTION INFORMATION
808
TIMING INFORMATION
810
E-MAIL COMPOSITION INFORMATION
812
FORMATTING INFORMATION

FIG. 8

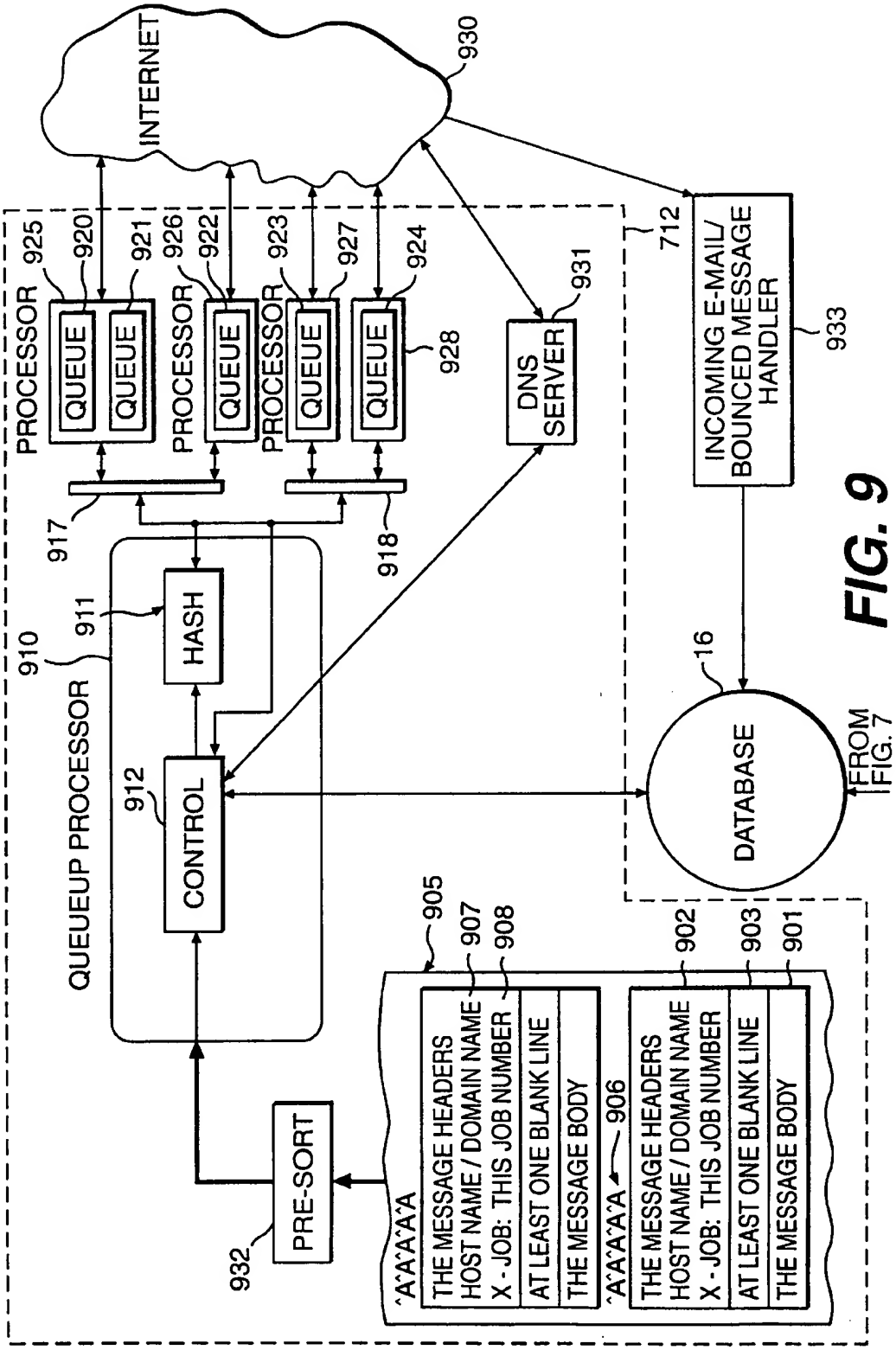

INTERNET
930
PROCESSOR
925
920
921
926
922
923
927
924
QUEUE
928
931
DNS SERVER
712
INCOMING E-MAIL/ BOUNCED MESSAGE HANDLER
933
917
918
910
911
HASH
912
CONTROL
QUEUEUP PROCESSOR
16
DATABASE
FROM FIG. 7
905
907
908
902
903
901
THE MESSAGE HEADERS
HOST NAME / DOMAIN NAME
X - JOB: THIS JOB NUMBER
AT LEAST ONE BLANK LINE
THE MESSAGE BODY
906
PRE-SORT
932

FIG. 9

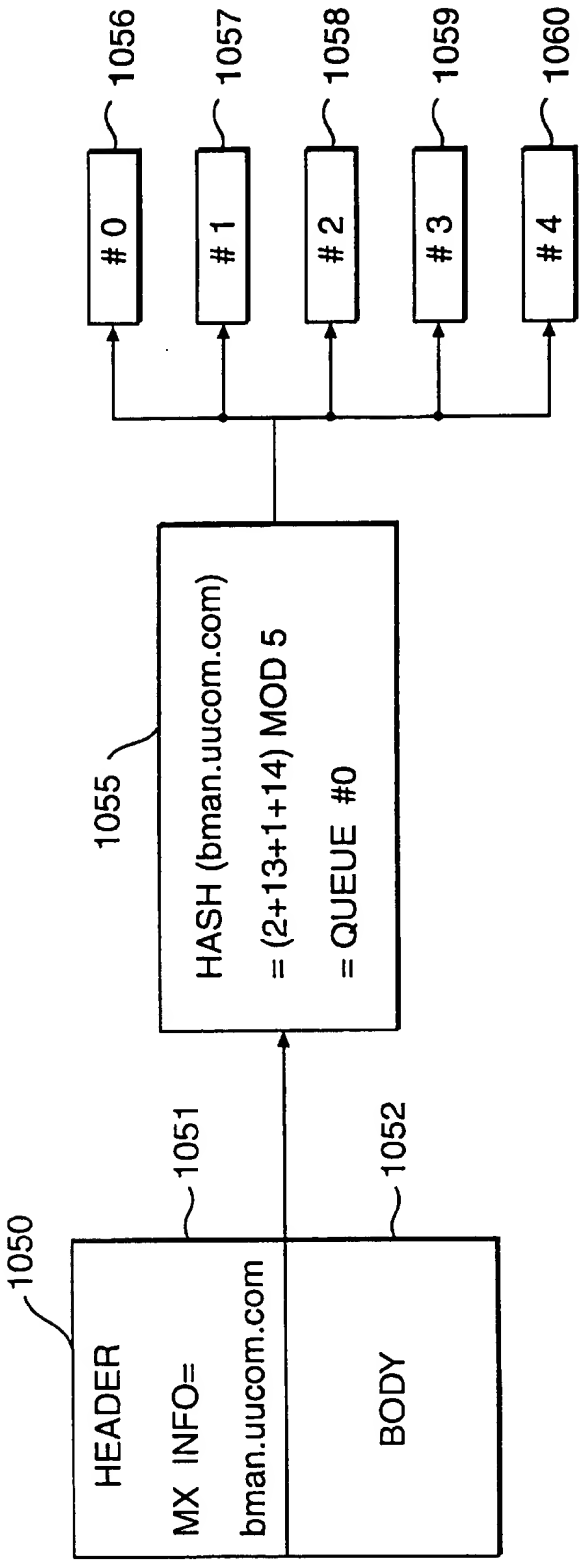

1056
1057
1058
1059
1060
0
1
2
3
4
1055
HASH (bman.uucom.com)
= (2+13+1+14) MOD 5
= QUEUE #0
1050
1051
1052
HEADER
MX INFO=
bman.uucom.com
BODY

FIG. 10

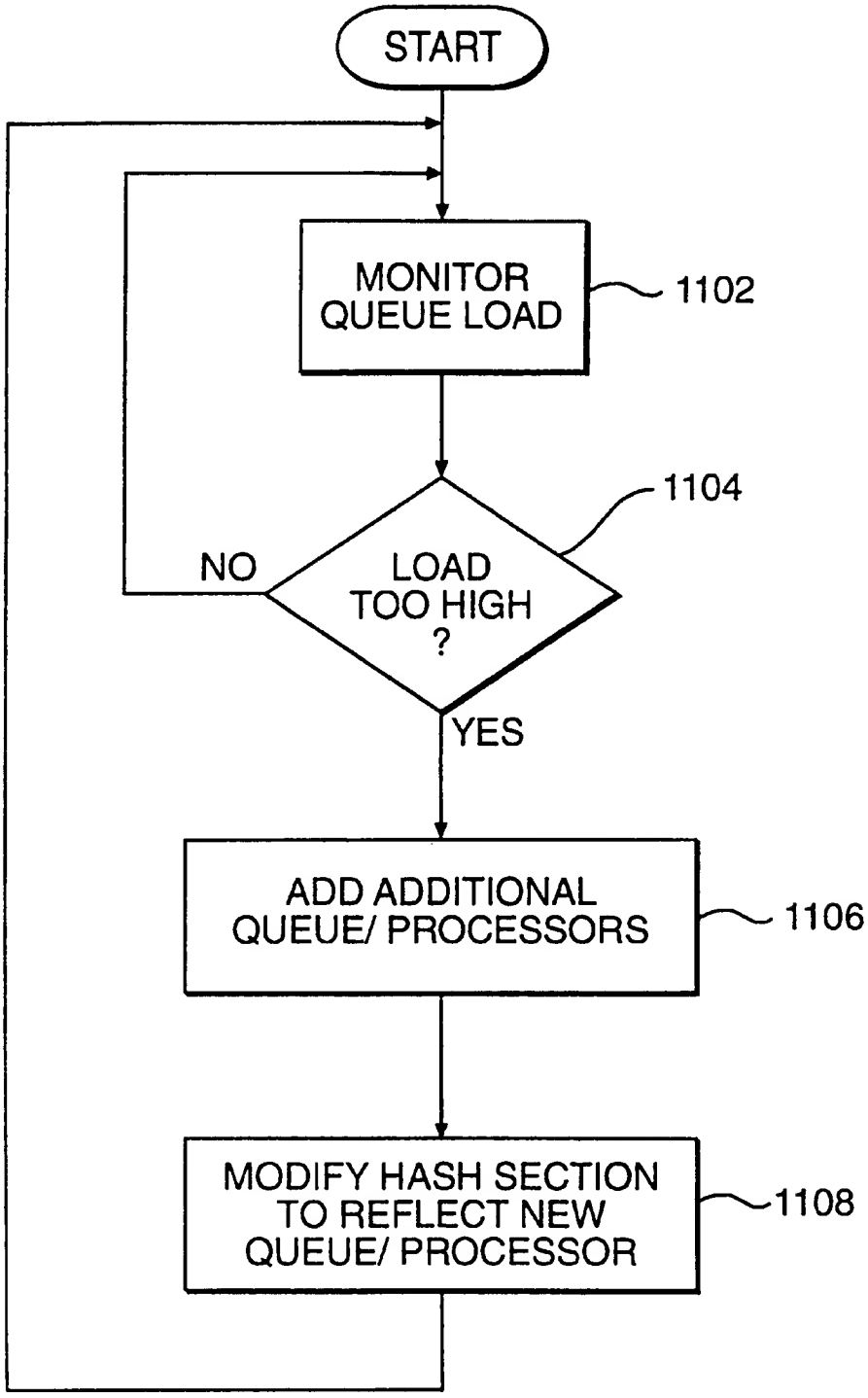

START
MONITOR QUEUE LOAD
1102
1104
NO
LOAD TOO HIGH ?
YES
ADD ADDITIONAL QUEUE/ PROCESSORS
1106
MODIFY HASH SECTION TO REFLECT NEW QUEUE/ PROCESSOR
1108

FIG. 11

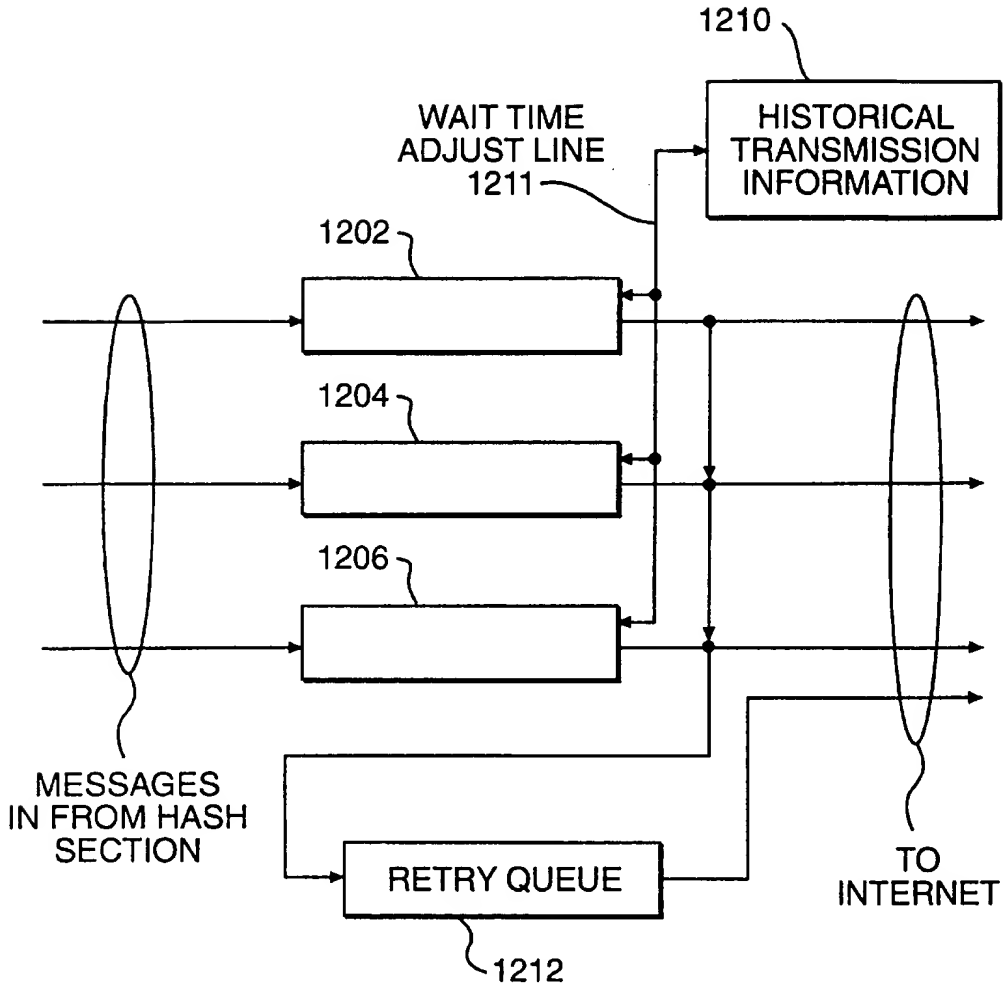

1210
HISTORICAL TRANSMISSION INFORMATION
WAIT TIME ADJUST LINE
1211
1202
1204
1206
MESSAGES IN FROM HASH SECTION
RETRY QUEUE
1212
TO INTERNET

FIG. 12

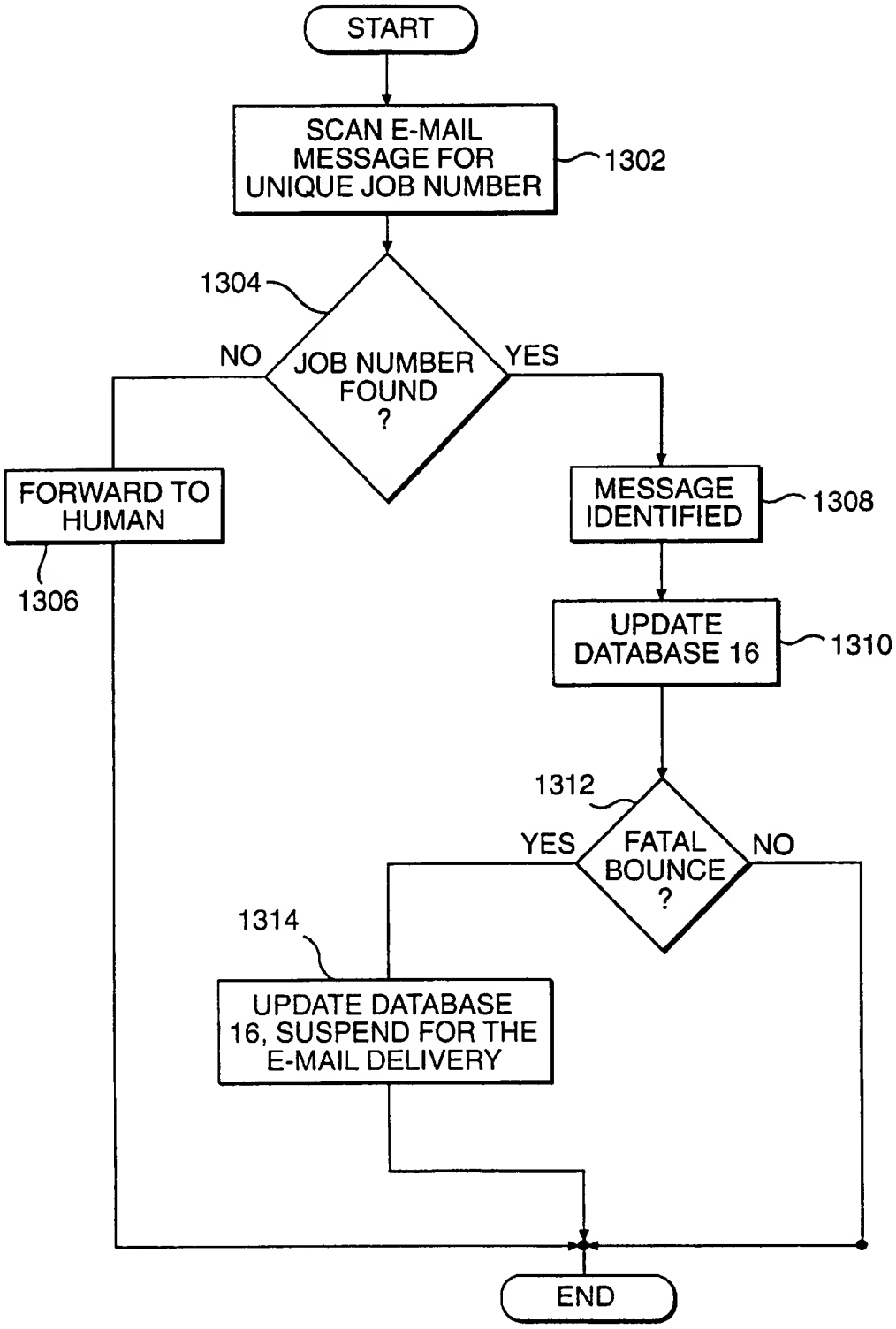

START
SCAN E-MAIL MESSAGE FOR UNIQUE JOB NUMBER
1302
1304
JOB NUMBER FOUND ?
NO
YES
FORWARD TO HUMAN
1306
MESSAGE IDENTIFIED
1308
UPDATE DATABASE 16
1310
1312
FATAL BOUNCE ?
YES
NO
1314
UPDATE DATABASE 16, SUSPEND FOR THE E-MAIL DELIVERY
END

FIG. 13

METHOD AND APPARATUS FOR HIGH VOLUME E-MAIL DELIVERY

RELATIONSHIP TO COPENDING APPLICATIONS

This application is a continuation-in-part application of copending U.S. application Ser. No. 08/431,254, filed Apr. 6, 1995, the content of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to electronic mail, and more particularly, to high volume electronic mail delivery systems and methods.

2. Description of the Related Art

Electronic mail ("e-mail") is to the 1990s what fax machines were to the 1980s—a must-have capability for any corporate employee or service professional. Additionally, consumers are increasingly adopting e-mail through on-line services. The Internet, for example, has linked disparate e-mail systems, creating a truly international distribution medium. It is estimated that over thirty million people have access to e-mail via the Internet today with an annual growth rate exceeding 100 percent.

Today, e-mail is used primarily as an interpersonal communication technology. Corporate users communicate with customers, vendors, peers, subordinates, and superiors, while residential users are increasingly using e-mail to stay in touch with friends and relatives.

End-users generally do not use e-mail as an information services tool, however. As noted above, most e-mail is generated by one person and sent to another person. Very little of the worldwide e-mail volume is created by a computer. This is due in no small part to the challenges of creating automated processes for the generation and distribution of large volumes of unique e-mail messages.

In the past five years, several services have been created with the goal of using e-mail as an information services tool by creating a type of personalized electronic newspaper. The services use computers (and proprietary software) to sift through news stories or press releases and select those articles/stories that match a predefined profile of a particular subscriber. Generally, the profile is based on particular industries or products; however, there may be options for somewhat more refined sifting criteria.

These services all have one thing in common—they manipulate publicly available information (AP wire service, Reuters, Business Wire, etc.) and match this information to a generic customer profile, not to a unique individual. The resulting personalized newspaper is sent via e-mail or facsimile to all subscribers that match the selected profile.

There are other companies that have started on-line services that allow end-users access to more personalized information, such as Compuserv, Prodigy, America-on-line, or World Wide Web home pages. These services allow end-users to get quotes on publicly traded securities and allow end-users to search databases for particular strings of text or subject matter. These services suffer from a common disadvantage, however, namely, they require the active involvement of the end-user in accessing the information. In other words, each time the end-user desires information, he must dial up the service provider and request the information.

The Internet is made up of thousands of computers loosely coupled to one another by a common protocol and fiber optic transmission backbones. Each e-mail sent over the Internet must contain an address specifying to whom the e-mail is to be delivered.

An Internet e-mail address, such as, for example, "jfunk@merc.com," includes the name of the user the e-mail is addressed to (i.e., "jfunk"), followed by an "@" symbol. The mnemonic after the "@" defines the local destination the e-mail is destined for. The destination may be a domain name such as "merc.com," which does not refer to a specific computer, but to a networked domain of computers. Alternatively, the destination may correspond to a specific computer, such as the destination "netra.merc.com," which references the computer named "netra" in the "merc.com" domain.

When the destination after the "@" symbol refers to a group of hosts under the same administrator, such as "merc.com," it is called a domain name. When the destination refers to a specific computer, such as "netra.merc.com," the destination is often referred to as the host, or hostname. Throughout this specification, "hostname" and "domain name" are used to refer to the symbolic destination of the to-be-delivered e-mail.

Hostnames exist for the convenience of humans. The actual routing of information on the Internet is done with Internet Protocol ("IP") addresses. An IP address is a 32 bit, non-symbolic number, which represents the unique address of a device connected to the Internet. Before a computer can deliver e-mail, it must first determine the correct recipient IP address. Mappings between hostnames and IP addresses are kept in a distributed database on the Internet called the Domain Name System (DNS). Before the computer transmits its e-mail, it queries the DNS with a host name and waits for the corresponding IP address to be returned.

Most hostnames correspond to at least one IP address. The hostname "www.merc.com," for example, corresponds to the IP Address 204.255.152.133. The domain name "merc-.com" is not a physical entity. It, therefore, has no IP Address and information cannot be directly routed to it. E-mail delivered to "merc.com" is sent to a site designated to receive e-mail for "merc.com." Alternate designated sites may be desirable even when the normal receiving site has an IP address. For example, an e-mail recipient may not want e-mails sent to his address at night if the computer is turned off.

The alternate designated sites for a hostname or domain name are called the hostname's Mail eXchanger (MX) hosts. A query of the DNS for the MX information on "jfunk@merc.com" will return a list of Internet hosts that will accept mail for "merc.com." If no alternate hosts are available, the query will indicate as much.

To transmit an e-mail message, a number of processing steps must be performed before the e-mail message is actually transmitted onto the Internet. Initially, a sending program determines whether it knows the current IP address corresponding to the e-mail hostname or MX hostnames. If not, the sending program queries the DNS for the IP address. The sending program then transmits an initial message to the destination, asking whether the destination computer can receive the e-mail. If the destination computer replies favorably, the sending program breaks the e-mail message up into a series of information packets, and separately transmits each packet. The destination computer receives the packets and reassembles them into the complete e-mail message.

Traditionally, e-mail transmission has been handled by a single sending program operating on a single queue of

messages. That is, e-mails to be transmitted are lined up in a first-in-first-out (FIFO) queue, and the queue is handled by a transmitting program. Although this method works well for low-volume e-mail transmission, for sites that transmit thousands, or even hundreds of thousands of e-mail messages a day, the above-described method is slow and significantly underutilizes network bandwidth because information is being sent over the Internet neither while the DNS is being queried nor while the transmitting program is waiting for the destination to acknowledge the initialization message.

Occasionally, a host site cannot complete delivery of an e-mail message. When this occurs, the host site typically returns ("bounces") the e-mail message back to the sender with an attached error message explaining why the message could not be delivered. The returned messages are called "bounced messages." A large number of received bounced messages is burdensome on the system operator, who must manually read through the messages to determine the appropriate action.

It is therefore desirable to provide an information delivery system and methods that substantially obviate one or more of the problems due to the limitations and disadvantages of the related art.

It is also an object of the present invention to provide a low-cost system that allows a user to passively receive unique, customized, personal information via e-mail and/or facsimile machine.

It is another object of the present invention to provide an e-mail processing system that allows a user to automatically edit user information by either sending an e-mail or interacting with the processing system via the World Wide Web (WWW).

It is still a further object of the present invention to provide an efficient, high volume e-mail transmission system and method.

It is still a further object of the present invention to provide an e-mail system and method to effectively, automatically handle bounced e-mail messages.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by means of the instrumentalities and combinations particularly pointed out in the written description and appended claims hereof as well as the appended drawings.

SUMMARY OF THE INVENTION

The advantages and purposes of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The advantages and purpose of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

To attain the advantages and in accordance with the purposes of the invention, as embodied and broadly described herein, in one embodiment, the invention is a system and method for controlling e-mail delivery to a plurality of destination hosts. Exemplarily, one method comprises the steps of routing outgoing e-mail messages to one of a plurality of e-mail queues, the routing being controlled such that e-mail messages with common destinations are routed to the same e-mail queues; and delivering the e-mail messages in each queue to a destination host designated by the e-mail messages.

In another embodiment, the invention is a method of tracking e-mail messages. This embodiment comprises the steps of: inserting a code into a first e-mail message; sending the first e-mail message with the inserted code over a network to a recipient; receiving a modified version of the first e-mail message, the modified version of the first e-mail message containing the code; and matching the received e-mail message with the first e-mail message based on the code.

In yet another embodiment, the invention is a method for forming an electronic mailing for delivery to subscribers on a network. In this embodiment, the method comprises the step of entering a record into a database for each of the subscribers. This step further includes the substeps of: selecting timing information indicating when the electronic mailing is to be assembled and delivered, selecting content information of the electronic mailing, and selecting formatting information of the electronic mailing. The method also includes the steps of: assembling the electronic mailing for each subscriber based on the record corresponding to the subscriber and transmitting the assembled electronic mailing to the subscriber.

The invention also includes corresponding systems for performing these processes and methods as disclosed and claimed.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate several preferred embodiments of the invention and, together with the description of the preferred implementations, serve to explain the principles of the invention.

In the drawings:

FIG. **1** is a block diagram of an information services system in accordance with one embodiment of the present invention;

FIG. **2** is a block diagram of a service processing system in accordance with one embodiment of the present invention;

FIG. **3** is a preferred embodiment of an e-mail message format generated by the service processing system in accordance with one embodiment of the present invention;

FIG. **4** illustrates sample database structures in accordance with one embodiment of the present invention;

FIG. **5** is a processing flow diagram illustrating the processing operations of the service processing system to set up and automatically generate an e-mail message in accordance with one embodiment of the present invention;

FIG. **6** is a processing flow diagram operation of the service processing system to modify a database based on inbound information in accordance with one embodiment of the present invention;

FIG. **7** is a block diagram showing an alternative service processing system in accordance with another embodiment of the present invention;

FIG. **8** is a block diagram illustrating an exemplary composition of an end-user configuration file for a service processing system in accordance with another embodiment of the present invention;

FIG. **9** is a block diagram showing a detailed view of an outbound e-mail processing section for a service processing system in accordance with another embodiment of the present invention;

FIG. **10** is a conceptual diagram illustrating the interaction of a hash section and queues for a service processing system in accordance with another embodiment of the present invention;

FIG. **11** is a flow chart showing a preferred method of dynamically scaling a number of queues/processors for a service processing system in accordance with another embodiment of the present invention;

FIG. **12** is a block diagram illustrating a system for reducing time wasted while an e-mail queue waits for an acknowledge signal from a destination host in accordance with another embodiment of the present invention; and

FIG. **13** is a flow diagram illustrating an automated bounced e-mail handling procedure for a service processing system in accordance with another embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the construction and operation of preferred implementations of the present invention which are illustrated in the accompanying drawings. In those drawings, like elements and operations are designated with the same reference numbers where possible.

The following description of the preferred implementations of the present invention is only exemplary of the invention. The present invention is not limited to these implementations, but may be realized by other implementations.

FIG. **1** is a block diagram of an information services system in accordance with one embodiment of the present invention. In a preferred embodiment, the information provided by the system is securities information, such as stocks, bonds, mutual funds, etc. However, the invention contemplates information of all kinds, including, e.g. account balances, charges and payments, cleared checks, weather update information, sports information, etc.

As shown in FIG. **1**, one or more information sources **100** are connected to a service processing system **104** by connections **102**. Connections **102** preferably include standard telephone line connections, but may include other conventional computer connections. Information sources **100** include any source of information such as the Associated Press, Reuters News, or The Wall Street Journal. Consistent with the preferred embodiment, one of the information sources **100** would obtain financial information from, e.g., a stock exchange.

Service processing system **104** connects via a connection **102** to the Internet **106** or some other e-mail network. End-user terminals **114** also connect to the Internet **106** via connections **102**, and the service processing system **104** provides the information to the end-user terminals **114** through the Internet **106**.

As discussed in more detail below, generally, service processing system **104** receives information from information sources **100**, translates that information into database format, and stores the translated information in databases corresponding to services provided by the service processing system **104**. Service processing system **104** then generates e-mail messages based on the contents of the databases and feeds those e-mail messages through the Internet **106** to enduser terminals **114**.

As also shown in FIG. **1**, e-mail messages can also be routed to end-user terminals **114** via a local area network ("LAN") **112**. The LAN **112** is connected to the Internet **106** by a connection **102**, and end-user terminals **114** are connected to the LAN via conventional LAN connections **113**.

Alternatively, e-mail messages can be delivered to an end-user by voice-mail or facsimile message delivery systems. As shown in FIG. **1**, a message delivery system **116** is connected to the Internet **106** via a connection **102**. The message delivery system **116** may provide for voice-mail services **110** and/or facsimile services **118**, in accordance with conventional techniques. As discussed in more detail below, if the service processing system **104** provides e-mail messages to a message delivery system **116**, the service processing system **104** can first translate the e-mail messages into the appropriate voice-mail or facsimile format for delivery to the message delivery system **116**. This translation is provided by text-to-voice processor **220** or facsimile processor **216**, respectively. Alternatively, e-mail messages may be delivered to the message delivery system **116** as a conventional e-mail message, and the message delivery system **116** can translate the e-mail message into the appropriate voice-mail or facsimile message format.

FIG. **2** is a block diagram of a service processing system **104** in accordance with one embodiment of the present invention. As shown, service processing system **104** preferably includes a plurality of databases, including a customer database **200**, source information database **202**, portfolio value database **204**, name and symbol database **206**, and message database **208**. The contents of each database **200–208** is described in more detail below.

In addition, service processing system **104** includes an inbound e-mail processor **212**, outbound e-mail processor **214**, facsimile processor **216**, voice response processor **218**, and text-to-voice processor **220**. The purposes and functions of each processor **212–220** will also be described in more detail below.

Each database **200–208** and each processor **212–220** is connected to a processor system **210**. Generally, processor system **210** receives information from information sources **100** and stores that information in one of databases **200–208**. As described in more detail below, at predetermined intervals, such as one per day, processing system **210** generates a temporary list or file of all information to be delivered via e-mails to end-users, then sends the file to either the outbound e-mail processor **214**, facsimile processor **216**, or text-to-voice processor **220**, depending on the delivery path. These processors **214**, **216**, and **220**, translate the file into e-mail format or message delivery format for the Internet **106**, depending on whether the e-mails will be delivered via e-mail message delivery system **116**.

Before describing the system operation for generating and transmitting e-mail messages, it is useful to consider an exemplary e-mail message format as displayed on an end-user terminal **114**.

FIG. **3** shows an exemplary e-mail message **300** to be sent to end-user, John Doe. The exemplary e-mail message **300** includes a first information field **302** to identify the user, the source of the e-mail, the name of the e-mail service, and the date. The e-mail message **300** also includes a message field **304**, which can include a text message as selected by the service provider. In the preferred embodiment where the invention provides stock quote information, field **306** lists selected companies (both exchange acronym and formal name), their stocks' present values, and the amount of gain or loss since a previous information period.

The preferred e-mail message **300** may also include information field **308** for providing customer portfolio balance information including total equity value and total cash balance for a customer's portfolio. Finally, an additional generic message field **310** may be included at the end of the message. As discussed in more detail below, messages for this field **310** can come from several sources, including third parties.

In accordance with the present invention, information for the various fields of **302–310** of the e-mail message **300** come from databases **200–208**. Before describing the system processing operations for generating an e-mail message from the database information, the content of certain databases used to generate the exemplary e-mail **300** will be described.

FIG. **4** shows the database information for the customer database **200**, source information database **202**, and the name and symbol database **206**. Specifically, in this preferred embodiment, customer database **200**, for each customer subscribing to the service, includes a customer record **201** (FIG. **2**), which lists thirty-seven fields relating to the service processor, the customer, and service. Column **4** of the listings in FIG. **4** provides a brief description of each field; hence, these descriptions need not be repeated here. With reference to fields **22–36**, however, customer database **200** preferably provides for a list of fifteen securities, each field containing one security.

The names and symbols for the securities (see field **306** of FIG. **3**) come from the names and symbols database **206** which, as shown in FIG. **4**, includes the company's exchange symbol (field **1**) and the formal name of the company associated with the symbol (field **2**).

Customer database information for a customer record **201** is generated each time a new customer subscribes to an information service. The information to complete the fields may be gathered by an operator, over a direct connection **102** or, in response to a request from a potential customer, service processing system **104** may send a customer field template to the potential customer, who can complete certain field information and mail the information in via conventional mail or e-mail.

Referring still to FIG. **4**, source information database **202** includes fields **1–11**. These fields are dynamically updated at a predetermined interval (e.g. once per day) or in real-time by an information source **100**. In the preferred stock quote embodiment, the information source **100** provides stock information at the close of a stock exchange business day. Column **4** of FIG. **4** provides a brief description of each field **1–11** in the source information database **202**; hence, these descriptions need not be repeated here.

FIG. **5** discloses the processing flow of the service processing system **104** for creating and distributing information e-mail for the preferred stock quote embodiment. The processing starts with the first customer record **201** in the customer database **200** (step **500**). Initially, processor system **210** opens a temporary list or file (step **502**). The temporary file will be filled in by the processor system **210** with the information from the various databases **200–208**, depending on the service. For example, in the preferred embodiment stock quote service, the processor system **210** provides the contents of fields **1–37** of the customer record from the customer database **200** to the temporary file (step **504**). Information from some of those fields will be used to complete fields **302** and **304** of the corresponding e-mail message **300** and to set up the information field **306** of the corresponding e-mail message **300**.

Based on the company symbols in fields **22–36** of customer database **200**, process system **210** goes to the name and symbol database **206** and writes to the temporary file the company name and symbol for the customer's selected securities (step **506**). This information provides the name and symbol information for field **306** of the e-mail message **300**. Process system **210** then writes the content of the source information database **202** to the temporary file for each security listed in the temporary file (step **508**). This source information provides the stock values and changes as listed in field **306** of the e-mail message **300**.

Next, process system **210** goes to the portfolio value database and inspects the portfolio value for a customer off a customer portfolio record **205**. Preferably, using the information stored in the customer's portfolio record **205**, the processor system **210** calculates new portfolio values based on the source information and updates the customer portfolio record **205**. Alternatively, the customer portfolio records **205** can be updated by an information source **100** or other third party. Process system **210** then takes the portfolio values from the portfolio value database **204** and adds that information to the temporary file (step **510**). This portfolio information provides the information for field **308** of the e-mail message **300**.

Finally, processor system **210** looks to the message database **208** for any messages for the customer and writes these messages to the temporary file (step **511**). These messages are used to fill message field **310** of the e-mail message **300**.

In accordance with the present invention, a party can connect to the processor system **210** and leave a message for a customer. The message may be received as an e-mail, facsimile, or voice message, then processed into electronic storage form by one of inbound e-mail processor **212**, facsimile processor **216**, or voice response processor **218**, in accordance with conventional techniques. The message is then stored in message database **208**. For example, message database **208** may be edited by a broker who desires to send the message: "John, please call me.-Dave S." If the broker sends an e-mail to the inbound processor **212**, with the appropriate key words, processor system **210** adds that message to the message database **208** for the customer. The key words may include words such as "message," which the processor system **210** recognizes and processes accordingly. The inbound message also includes a customer selector field to identify a customer or class of customers.

After completing the temporary file for a customer, processor system **210** determines whether there are more customer records **201** in the customer database **200** (step **512**). If not, processor system **210** closes the temporary file and passes it to the outbound e-mail processor **214** (step **514**). If, however, other customer records remain in the customer database **208**, the system advances to the next record (step **518**), and begins to process that customer record at step **504**. Alternatively, processor system **210** may close each temporary file and pass it to the outbound e-mail processor **214** after completing the file for each customer.

The outbound e-mail processor **214** translates the temporary file into individual e-mail messages for each subscriber and sends the e-mail messages to an end-user terminal **114** through Internet **106** (step **516**). The translation of the e-mail messages from the temporary file are performed in accordance with Internet transfer protocols.

In accordance with the present invention, a customer can also modify his/her services by modifying his/her customer record **201**. As with input messages discussed above, a customer can modify a customer record via e-mail,

facsimile, or voice-mail using the corresponding processors **212**, **216**, or **218**.

FIG. **6** illustrates a processing flow diagram for providing this modification via an e-mail message. Initially, an e-mail message is received by the inbound e-mail processor **212**, translated, and passed to processor system **210** (step **600**). Based on key words in the content of the message, processor system **210** learns that it should modify one or more customer records and locates the customer's database record(s) **201** (step **602**). For example, the inbound e-mail message may include a field that says "edit" or "modify," which processor system **210** recognizes as an instruction to edit or modify one or more customer records. Processor system **210** then looks to another field of the e-mail message that identifies one or more customer's name(s) or number(s). After locating the customer record(s), processor system **210** then edits the database record based on the content of the e-mail message (step **604**). Processor system **210** can, optionally, create a log of the transaction for backup purposes (step **606**), then generate an e-mail to send back to the customer concerning the edits to the database (step **608**).

In accordance with the present invention, processor system **210** comprises a personal computer or a larger workstation. Databases **200–208** preferably comprise relational database software, e.g. Oracle or Sybase. Also, processors **212–220** may comprise a separate computer from processor system **210** or may be the same computer as processor system **210**.

FIG. **7** is a block diagram showing an alternative embodiment of a service processing system **104** in accordance with another embodiment of the present invention. According to this embodiment, for each customer of the system, a personal configuration file is created containing the information resources that the end-user would like e-mailed to his desktop. The configuration file is highly customizable, allowing the customer detailed control over the content, format, and timing of the delivered e-mails.

As discussed in greater detail below, in this embodiment, the e-mail messages to be sent are preferably hashed to multiple, parallel transmission queues based on their destination MX hosts. This novel arrangement of transmission queues significantly increases total e-mail output because multiple queues are simultaneously processing the e-mail transmissions.

In this embodiment, a unique job number may also be appended to each e-mail message as it is created. The job number is used by the system to identify and track the e-mail message through the system before it is transmitted, and if the message bounces, when it returns to the system.

As shown in FIG. **7**, service processing system **104** preferably has access to a plurality of source information databases **702***a–d*, each similar to database **202**. Preferably, source information databases **702***a–d* contain information on a variety of topics, such as, sports **702***a*, financial **702***b*, hobbies (such as skiing) **702**(*c*), or weather **720**(*d*); however, the present invention contemplates any type of information. Information is retrieved from the databases **702** by timing processor **704** and forwarded to e-mail composition processor **706**. From there, it is processed by formatter **708** and then sent to e-mail tracker **710**. Finally, the information is transmitted to out-bound e-mail processor **712**, where it is delivered.

In this embodiment, a database **16** preferably stores information relating to customer account information and system delivery information. Alternatively, database **16** could be implemented as multiple databases, such as databases **200**, **204**, **206**, and **208** shown in the embodiment of FIG. **2**.

Database **16** stores, for each customer, a personal configuration file including fields describing each customer's desired electronic message configuration and provides such information to the timing processor **704**, e-mail composition processor **706**, and formatter **708**.

Through customer profile configuration processor **714**, each customer may individually modify his account configuration via e-mail or conventional telephone systems, as was previously described with reference to the embodiment of FIG. **2**. Alternatively, a customer may modify his account via the World-Wide-Web ("WWW"). If the WWW is used as an interface to profile configuration processor **714**, the customer may view the status of his account, including seeing which e-mail messages have been sent. The customer profile configuration processor **714** modifies the corresponding customer fields in database **16** to reflect the updated customer account information.

In operation, timing processor **704** determines, based on each customer's account information, when to initiate preparation of an e-mail message for delivery. The timing section provides flexible, highly configurable customer control over when and what should be delivered to the customer. For example, the customer's account information may indicate that information from certain databases should be delivered periodically (e.g., send a weather report every six hours). Alternatively, the account information may indicate that information should be delivered based on an external action (e.g. when the customer sends a requesting e-mail to the system or when a certain stock drops below a preset threshold). Finally, the timing processor may determine that information is to be mailed to customers based on discretionary actions of a system administrator.

The timing processor **704** works in conjunction with the e-mail composition processor **706** to assemble the customer's electronic message. E-mail delivery initiated in the timing processor **704** is assembled in its final substantive form by the composition processor **706**. Based on information from the timing processor **704** and customer account information from the database **16**, the composition processor **706** determines: who shall receive the delivery, e.g., a unique individual broadcast or a group of end-users; what pieces of information are to be assembled for each individual end-user; and, when there are multiple pieces of information for delivery, whether the customer would like the information delivered as a series of e-mail messages or as one encapsulated e-mail message.

The composition processor **706** may insert general or targeted advertisements into the electronic message. In the case of targeted advertisements, the composition processor may decide add or delete advertisements based on the customer account information or on information already assembled into the message.

After the e-mail messages are prepared for content by the timing processor **704** and the e-mail composition processor **706**, the e-mail messages are formatted into their final delivery form by the formatter **708**. The formatter **708** formats the e-mails to a customer chosen format indicated in the customer configuration file. There are many potential ways to format an e-mail message, the customer's choice will generally depend on the hardware and software the customer is using to view the delivered mail. Exemplary formats include: standard text only; rich text format (RTF); Hyper-Text Markup Language (HTML); or a system customized format. Preferably, the system defaults to a text only format because this format is viewable by all e-mail readers, although HTML formatting is particularly desirable, if available, because it permits graphic-based viewing.

For each piece of e-mail to be delivered, e-mail tracking section **710** creates a record in the database **16**, identifying the e-mail. Further, e-mail tracking section **710** appends a unique job number to each piece of e-mail to identify the e-mail with its corresponding record. Given a job number, a lost or garbled message can be reassembled and delivered. As the e-mail progresses through service processing system **104**, its record is updated.

Finally, the e-mail messages are sent to the out-bound e-mail processing section **712**, where they are transmitted to the customers. The out-bound e-mail processing section **712** is described in further detail below with reference to FIG. **9**.

FIG. **8** is a block diagram illustrating an exemplary composition of a customer configuration file according to the alternative embodiment of service processing system **104**. Section **802** contains customer identification information, similar to fields **1–14** shown in FIG. **4**. Optional field **804** contains background information about the customer such as, for example, age, annual income, and hobbies. Preferably, the background information is used to intelligently target product advertisements to the customer. Field **806** contains information describing the information services the customer has subscribed to. Fields **808**, **810**, and **812** contain information relating to the timing information, the e-mail composition information, and the formatting information, respectively, used by the timing section **704**, e-mail composition section **706**, and the formatting section **708**, respectively.

The customer configuration file **800**, stored in database **16**, forms the basis for the individually customizable e-mail message configuration. Customer's may conveniently view or modify their configuration file through profile configuration processor **714**. The customer configuration file may be organized in many alternative formats, and still effectively store the end-user's specific information choices.

FIG. **9** is a block diagram showing the outbound e-mail processor **712** in greater detail.

Processing section **712** receives message stream **905** from mail tracking processor **710**, containing a series of e-mails separated by control characters **906**. Each e-mail message includes a message header section **902** and a message body **901**. A blank line **903** separates the header section **902** from the body **901**.

The header section preferably includes the hostname or domain name **907** of the intended recipient and a unique job number **908** identifying the e-mail within the system. The job number **908** was previously created by the mail-tracking section **710**. To speed up message delivery time, the message stream **905** may be pre-sorted by pre-sorting processor **932**, such that similar or identical destination addresses are grouped together.

The message stream **905** is input to Queueup processor **910**, which includes hash processor **911** and control processor **912**. Control processor **912** separates each individual message from the message stream and then forwards the message to hash processor **911**. Additionally, control processor **912** updates each e-mail's record in database **916** on the progress of the messages through the system and initiates queries to DNS server **931**. Hash processor **911** forwards each message to one of queues **920–924** based on a hash of the message MX information, as described in more detail below.

Preferably, DNS server **931** queries the Internet DNS to obtain the IP addresses and MX information required to deliver the e-mail messages. The IP addresses and MX information is returned to the control processor **912**, and is eventually used by the queues and the hash processor **911** in transmitting packets across the Internet. Preferably, for e-mail messages with known future delivery times, DNS server **931** queries the Internet DNS in advance of the delivery time, and stores the returned information in database **16**. By relieving the queues of the responsibility of querying the Internet DNS, and by querying the Internet ahead of the scheduled e-mail delivery time, the DNS server **931** speeds message delivery. Alternatively, one may remove DNS server **931** and force the queues to individually query the Internet DNS for the IP addresses and MX information.

A destination site that receives a large volume of e-mail may designate multiple hosts to accept such e-mail. For example, the MX information for a large Internet provider such as aol.com may be:

aol.com preference=15, mail exchanger=b.mx.aol.com
aol.com preference=15, mail exchanger=c.mx.aol.com
aol.com preference=15, mail exchanger=d.mx.aol.com
aol.com preference=15, mail exchanger=e.mx.aol.com
aol.com preference=15, mail exchanger=f.mx.aol.com
aol.com preference=15, mail exchanger=a.mx.aol.com

This indicates that e-mail sent to aol.com should be sent to one of six hosts, b.mx.aol.com through a.mx.aol.com, all with an equal preference for receiving the e-mail. Preferably, when the DNS server **931** queries the Internet DNS and obtains MX information including multiple hosts, all with an equally low delivery preference, the DNS server will randomly pick one of the hosts and transmit that chosen host to control processor **912** and database **16**. This ensures that the hash processor **911** will uniformly queue the messages over the available queues, thus reducing clumping in a queue that may otherwise occur when there is one destination receiving an exceptionally high volume of e-mail.

Local Area Network (LAN) **918** preferably couples queueup processor **910** with processors **927** and **928**. Similarly, LAN **917** preferably couples the queueup processor **910** with processors **925** and **926**. Multiple LANs transferring information to processors **925–928** increases the total bandwidth to the processors **925–928**. Accordingly, more or less LANs could be installed depending on system bandwidth requirements. Processors **925–928** transmit and receive packets over a network such as the Internet, illustrated as element **930**.

Processors **925–928** and queues **920–924** may be connected to multiple networks in addition to the Internet. For example, while processors **925**, **926** may be connected to the Internet, processor **927** may be connected to a second network, such as the MCI network, and processor **928** to a third network, such as the Sprint network. In this situation, control processor **912** and hash algorithm **911** may increase the speed with which selected e-mails are delivered by routing e-mails to the queues that connect to the network matching the e-mail destination. For example, the hashing routine may be adapted so that an e-mail destined to a subscriber on the MCI network will be hashed to queue **923**, which resides on the processor connected to the MCI network. Likewise, for preferred or dedicated hosts, often associated with large providers, the hash processor may be adapted to place all e-mail for the preferred host in one or more queues specifically tuned for delivery to that host.

Processors **925–928** send status and error information to control processor **912**, which forwards the information to the appropriate e-mail record in database **16**. Preferably, database **16** is notified when the e-mail messages enter the queues **920–924** and as they are transmitted to the Internet. In this manner, the status of an e-mail message as it

progresses through the system can be determined by querying the database **16**.

Incoming e-mail/bounced message handler **933**, described in more detail below, receives and processes incoming e-mail messages.

FIG. **10** is a conceptual diagram illustrating the interaction of a hash section and queues for the service processing system in accordance with another embodiment of the present invention.

E-mail message **1050** contains header information **1051** and body **1052**. In this example, the header information **1051** includes the MX hostname information "bman.uucom-.com." Hash processor **1055** receives the message **1050** and forwards it to a selected one of queues **1056–1060** based on the hostname. Queues **1056–1060** process and transmit the message.

Hash algorithms are well known in the art, and there are many suitable hash algorithms which may be implemented in hash processor **1055**. For example, a simple hash algorithm may be: (a) truncate the MX information to its first four letters (e.g., bman), (b) add the letters together according to the position of the letters in the alphabet (b=2, a=1, m=13, n=14), (c) and divide by the number of available queues, using the remainder as the queue to select (30/5=6 R 0). Although the hash section **1055** is shown here as operating on a symbolic name, alternatively, the hash operation may operate on an IP address.

Hash processor **1055** may implement an "adaptive" hash by altering the hash algorithm based on input from control processor **912**. This is desirable in situations such as the one described above, in which processors **925–928** are connected to multiple networks in addition to the Internet.

The novel arrangement of multiple, parallel queues to transmit e-mail, as shown in FIGS. **9** and **10**, significantly increases total e-mail output because multiple queues are simultaneously processing e-mail transmissions. Hashing the messages to the queues so that the messages are delivered evenly while keeping the same destinations in the same queues ensures that the queue load will be generally balanced. Because setting up and closing the initial e-mail connection between a transmitting and receiving host is one of the more time consuming steps in e-mail transmission, the chance of two back-to-back messages sharing the same destination is increased in the present invention because like destinations are hashed to the same queue. In this situation, transmission time will decrease because the queue does not have to close and then reinitialize the same destination.

The out-bound e-mail processing section **712**, shown in FIGS. **7** and **9**, may be scaled to dynamically increase its e-mail throughput. That is, based on message load, additional queues or processors may be quickly brought on-line and the hashing algorithm adjusted to accommodate for the added queues or processors.

FIG. **11** is a flow chart showing a preferred method of dynamically scaling a number of queues/processors. Control processor **912** monitors the message input load (step **1102**), and if the load is determined to be too high (step **1104**), an additional queue is added (step **1106**). Next, the hash algorithm is adjusted to reflect the new queue by increasing the range of the hash algorithm (step **1108**). Control processor **912** may bring additional processors on-line as needed to accommodate the additional queues.

The method of dynamically scaling to add new processors/queues, as shown in FIG. **11**, may also, with little modification, be applied to reduce the number of active processors/queues. Down scaling the system may be desirable during off-peak message delivery times or when a processor malfunctions and needs to be quickly taken off-line for repairs.

E-mail transmission from each of queues **920–924** to the Internet will now be described.

The transmitting portion of queues **920–924** are preferably a commercially available e-mail package such as SENDMAIL. When transmitting e-mail, SENDMAIL packages each e-mail in an envelope analogous to an envelope that a paper letter is mailed in. Before transmission, queues **920–924** insert a copy of unique job number **908** into the envelope created by SENDMAIL.

Before each e-mail can be transmitted, the queue must obtain the IP address that the e-mail is to be routed to. As discussed previously, the queue may itself query the Internet DNS for the IP address or if a valid IP address is known by the system, the queue will get the IP address from control processor **912**. Next, the queue sends an initialization message to the destination host, inquiring if the host is ready to receive the e-mail message. If the host responds favorably, e-mail transmission is initiated.

Occasionally, the time elapsed between the initialization message and the acknowledgment message may become excessively long, unduly backlogging the queue. Traditionally, if too much time elapses, the queue will end the transmission of the e-mail, and either immediately retry transmitting the e-mail message or resubmit the e-mail message at the end of the queue.

FIG. **12** is a block diagram illustrating a system for reducing time wasted while an e-mail queue waits for an acknowledge signal from a destination host in accordance with another embodiment of the present invention. Queues **1202, 1204,** and **1206** receive input e-mail messages from the hash processor **911** for transmission over the Internet. Each queue has a set wait time between the queue's initialization message and the reception of the acknowledgment message, after which the queue will terminate transmission of the e-mail message and forward it to the re-try queue **1212**. Re-try queue **1212** is a secondary queue for transmitting troublesome e-mails. Preferably, re-try queue **1212** is set to wait a much longer time for acknowledgment from the destination hosts then the main queues **1202, 1204,** and **1206**. E-mails addressed to slow-to-respond destination hosts are moved out of the main transmission queues **1202, 1204,** and **1206**, and into re-try queue **1212**, and therefore the main queues are not unduly slowed down.

Historical transmission information processor **1210** may be optionally implemented in the embodiment shown in FIG. **12**. Processor **1210** is connected to queues **1202, 1204,** and **1206** by wait time adjust line **1211**. Through line **1211**, processor **1210** controls the wait times of queues **1202, 1204,** and **1206**.

In operation, processor **1210** dynamically adjusts the wait times of queues **1202, 1204,** and **1206** based on historical feedback. That is, processor **1210** monitors the destinations of the e-mails and the wait times they required in previous transmissions. Based on this historical analysis, processor **1210** sets the wait times for queues **1202, 1204,** and **1206**. In this manner, destinations that previously required a short wait time will be set with a relatively short wait time, while destinations that previously required a longer wait time will be set with a relatively longer wait time. A wait time exceeding the set wait time indicates that there is a problem with the destination host, and the e-mail is forwarded to the re-try queue **1212**. Alternatively, instead of setting a long wait time for e-mails that previous required a long wait time, processor **912** may force the e-mail to skip the main queues **1202, 1204,** and **1206** altogether, immediately forwarding

them to re-try queue **1212**. In this manner, queues **1202**, **1204**, and **1206** are kept as "clean" as possible, thus facilitating efficient, high volume e-mail delivery.

E-mail received by the system generally takes one of two forms: original e-mail created by a human, or e-mail returned to the system because of a transmitting error ("bounced e-mail"). The incoming e-mail/bounced e-mail handling processor **933** automatically determines, in most situations, which of the received e-mails have been bounced and takes appropriate action, as described below.

FIG. **13** is a flow diagram illustrating an automated bounced e-mail handling procedure for a service processing system in accordance with another embodiment of the present invention.

Received e-mail messages are first scanned by processor **933** for the unique job number inserted by the mail tracking processor **710** into the message header and the message envelope (step **1302**). If a job number is not found, processor **933** forwards the e-mail to a human for review (steps **1304**, **1306**). If a job number is found within the e-mail, it is associated with the transmitted e-mail, and the database **16** is updated to indicate that the message bounced (steps **1304**, **1308**, and **1310**). Next, at step **1312**, processor **933** determines if the message is a fatal bounce. If the bounce is fatal, which indicates that the end-user will probably never be able to receive mail at the listed address, the system updates database **16** to indicate that further e-mail deliveries to that address should be suspended (step **1314**). A fatal bounce is indicated by, for example, an unknown user or an undeliverable mail message in the subject line of the bounced e-mail.

In the embodiments shown in FIGS. **7–13**, service processing system **104** is implemented as a network of computers with appropriate software and related hardware. In particular, timing processor **704**, e-mail composition processor **706**, formatter **708**, e-mail tracking processor **710**, pre-sorting processor **932**, hash processor **911**, and control processor **912** are preferably implemented as software. The software may be stored on any computer readable medium, such as a compact or magnetic disk. Specific hardware to implement the above is preferably a Unix-based system such as Sun SparcStation 5 machines with 128 k RAM, and 4 gig of hard drive space. The SparcStations are networked with a 10 Megabit Ethernet connection and communicate using TCP/IP protocols.

While there has been illustrated and described what are at present considered to be preferred embodiments and methods of the present invention, it will be understood by those skilled in the art that various changes and modifications may be made, and equivalents may be substituted for elements thereof without departing from the true scope of the invention.

In addition, many modifications may be made to adapt a particular element, technique or implementation to the teachings of the present invention without departing from the central scope of the invention. Therefore, it is intended that this invention not be limited to the particular embodiments and methods disclosed herein, but that the invention include all embodiments falling within the scope of the appended claims.

We claim:

1. An electronic mail (e-mail) delivery system, comprising:

a plurality of delivery queues for delivering e-mail to a plurality of destination hosts, the delivery queues being maintained on one or more processors;

a stream of messages, each message in the stream including a destination address for specifying a recipient of the message and a message body;

a routing processor for receiving the stream and routing the messages in the stream to one of the plurality of delivery queues based on the destination address.

2. The system of claim **1**, wherein the routing processor includes hash means for hashing the messages based on the destination addresses.

3. The system of claim **1**, further including means to dynamically adjust the number of the delivery queues based on an input message load.

4. The system of claim **1**, further including means to dynamically adjust the number of delivery queues being used at any one time based on the number of processors.

5. The system of claim **1**, further including means to dynamically adjust the number of routing processors based on an input message load.

6. The system of claim **5**, further including a plurality of local area networks, the routing processors being located on different ones of the plurality of local area networks.

7. A system according to claim **1**, wherein the destination address corresponds to a mail exchanger host of the destination recipient.

8. The system of claim **1**, further comprising a domain name server for querying a distributed database on the Internet and receiving a list of mail exchanger host addresses in response to the query.

9. The system of claim **1**, further including means for sorting the input stream based on the destination addresses prior to the input stream being received by the routing processor.

10. A method for controlling electronic mail ("e-mail") delivery to a plurality of the destination hosts, comprising the steps of:

routing outgoing e-mail messages to one of a plurality of e-mail queues, the routing being controlled such that e-mail messages with common destinations are routed to the same e-mail queues;

delivering the e-mail messages in each queue to a destination host designated by the e-mail messages.

11. A computer readable medium including instructions for operating a processor to deliver electronic mail ("e-mail") to a plurality of destinations, the instructions designed to perform the steps of:

routing outgoing e-mail messages to one of a plurality of e-mail queues, the routing being controlled such that e-mail messages with common destinations are routed to the same e-mail queues;

delivering the e-mail messages in each queue to a destination host designated by the e-mail messages.

12. A method for controlling electronic mail ("e-mail") transmission, comprising the steps of:

routing outgoing e-mail messages to one of a plurality of e-mail queues, the routing being controlled such that the e-mail messages with common destinations are routed to the same e-mail queues;

initiating a delivery protocol for each said e-mail message in each said queue;

waiting a predetermined period for acknowledgment of a successful delivery of the e-mail message;

removing the e-mail message from the queue when the predetermined waiting period has elapsed.

13. The method of claim **12**, further including the step of notifying a database as the outgoing e-mail messages are routed to the e-mail queues.

14. The method of claim **13**, further including the step of notifying the database upon successful delivery of the e-mail message.

15. The method of claim **12**, wherein the waiting step includes the step of dynamically adjusting the waiting period based on e-mail message histories.

16. A method according to claim **12**, wherein the routing step includes the step of hashing the e-mail destinations to

determine which one of the plurality of e-mail queues the messages will be routed to.

17. A method according to claim **12**, wherein the removing step further includes the step of transferring the removed e-mail messages to a queue dedicated to delivering removed e-mail messages.

18. The method of claim **16**, wherein the step of hashing includes the step of dynamically adjusting a hash algorithm to alter distribution of the routed e-mail messages.

19. A method of tracking electronic mail (e-mail) messages by an e-mail delivery system, the method comprising the steps of:

inserting a code into a first e-mail message to uniquely identify the first e-mail message;

sending the first e-mail message with the inserted code over a network to a recipient;

receiving a second e-mail message containing the code; and

matching the second e-mail message with the first e-mail message based on the code.

20. The method of claim **19**, wherein the inserting step includes the step of inserting the code into a message identification field and an envelope of the first e-mail message.

21. The method of claim **19**, wherein the sending step includes the step of updating a database to indicate that the first e-mail message has been transmitted.

22. The method of claim **19**, wherein the matching step further includes the step of updating the database to indicate that the second e-mail message has been identified with the first e-mail message.

23. The method of claim **19**, wherein the network is the Internet.

24. The method of claim **19**, wherein the second e-mail message is an error message indicating that the first e-mail message could not be successfully delivered.

25. The method of claim **24**, further including the step of updating the database to indicate when the error message is a fatal error message.

26. A method according to claim **19** in which the inserting step inserts the code into a message identification field of the e-mail message.

27. A method of tracking electronic mail ("e-mail") messages sent and received from a central mailing site to recipients on a network, comprising the steps of:

inserting a code into a first e-mail message;

sending the first e-mail message with the inserted code from the central site to the recipient via the network;

receiving, at the central site, a second e-mail message containing the code; and

matching the second e-mail message with the first e-mail message based on the code.

28. A method according to claim **27**, wherein the code of the first e-mail message uniquely identifies the first e-mail message.

29. The method of claim **27**, wherein the sending step includes the step of updating a database to indicate that the first e-mail message has been transmitted.

30. The method of claim **29**, wherein the matching step further includes the step of updating the database to indicate that the second e-mail message has been identified with the first e-mail message.

31. A method for forming an electronic mailing for delivery to subscribers on a network, the method comprising the steps of:

entering a record into a database for each of the subscribers, the entering step including the substeps of:

selecting timing information indicating when the electronic mailing is to be assembled and delivered,

selecting content information of the electronic mailing, and

selecting formatting information of the electronic mailing;

assembling the electronic mailing for each subscriber based on the record corresponding to the subscriber; and

transmitting the assembled electronic mailing to the subscriber.

32. A method according to claim **31**, wherein the entering step is performed by a subscriber through a world wide web interface.

33. A method according to claim **31**, wherein the entering step is performed by a subscriber through e-mail.

34. A method according to claim **31**, the formatting information indicating that the electronic mailing is to be formatted as one of: Rich Text Format (RTF), Hyper-text Markup Language (HTML), and text format.

35. A method according to claim **31**, the timing information indicating that the electronic mailing is to be assembled based on an event.

36. A method according to claim **31**, the timing information indicating that the electronic mailing is to be periodically assembled.

37. A method according to claim **31**, wherein the selecting formatting information step includes the step of selecting formatting information based on compatibility of the subscriber with the selected formatting information.

38. A method according to claim **31**, wherein the assembling step includes inserting a general advertising message into the mailing.

39. A method according to claim **31**, wherein the assembling step includes inserting a targeted advertising message into the mailing based on the record corresponding to the subscriber.

40. A method according to claim **31**, wherein the assembling step includes inserting a targeted advertising message into the mailing based on the selected content information.

41. A method according to claim **31**, wherein the assembling step deletes a general advertising message in the mailing based on an analysis of the record corresponding to the subscriber.

42. An electronic mail (e-mail) delivery system, comprising:

a plurality of delivery queues for delivering e-mail to a plurality of destination hosts, the delivery queues being maintained on one or more processors;

a stream of messages, each message in the stream including a destination address for specifying a recipient of the message and a message body;

a routing processor for receiving the stream and routing the messages in the stream to one of the plurality of delivery queues based on a sort criteria.

43. The method of claim **19**, further comprising the step of correlating the recipient of the first e-mail message to the second e-mail message.

44. The method of claim **25**, wherein the step of updating the database includes the substep of indicating that no more e-mail messages should be delivered to the recipient.

45. The system of claim **2**, wherein the routing processor dynamically adjusts the hashing when the number of messages in a particular queue is determined to be too high.

46. The system of claim **1**, wherein the routing processor adjusts the routing of the messages when the number of messages in a particular queue is determined to be too high.

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